

Sometimes Looking Into The Future Requires A Different Way of Thinking and Different Expectations

On-route, opportunity-charging station with retracting charge-head



Lightweight all-composite body

The Proterra Fast Charge Battery Electric Bus and Charging Station

*With a charge rate of **10 minutes** and a range of 30+ miles, transit will never be the same*



What Characterizes Transit Over the Next 20 Years?



Crippling increases liquid fuel prices due to increasing scarcity of fossil fuels coupled with greater competition (particularly from China and India) to feed their growing demand for liquid fuel



Mandated pressure to reduce emissions and increase utilization of renewable energy sources



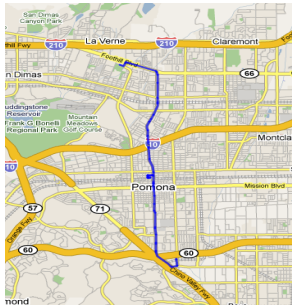
Rising demand on scope of services provided to passengers to serve increased ridership, changing demographics, congestion mitigation and accessibility



Increasing unsubsidized infrastructure and other operating expenses including wage rate increases

City And Trolley Bus Routes Are Highly Predictable

Potential Local Destinations



Foothills Route Map



San Antonio Riverwalk



Seattle

- Typical routes are ~10-30 miles round trip
- The same routes repeated all day
- Vehicles make scheduled stops to pick up and drop off passengers / layovers

Vehicle use is highly predictable
Solution designed to match duty cycle

- Vehicles are equipped with optimal size energy storage system
- Can replace today's trolleys without overhead wires
- Use to extend and/or replace electric bus routes from current wired infrastructure

Proterra's Products Are Ideally Suited For Transit

Drive on route
for 1 - 3 hours

Stop along the
route to charge for
up to 10 minutes

Drive all day
Stop to charge as needed

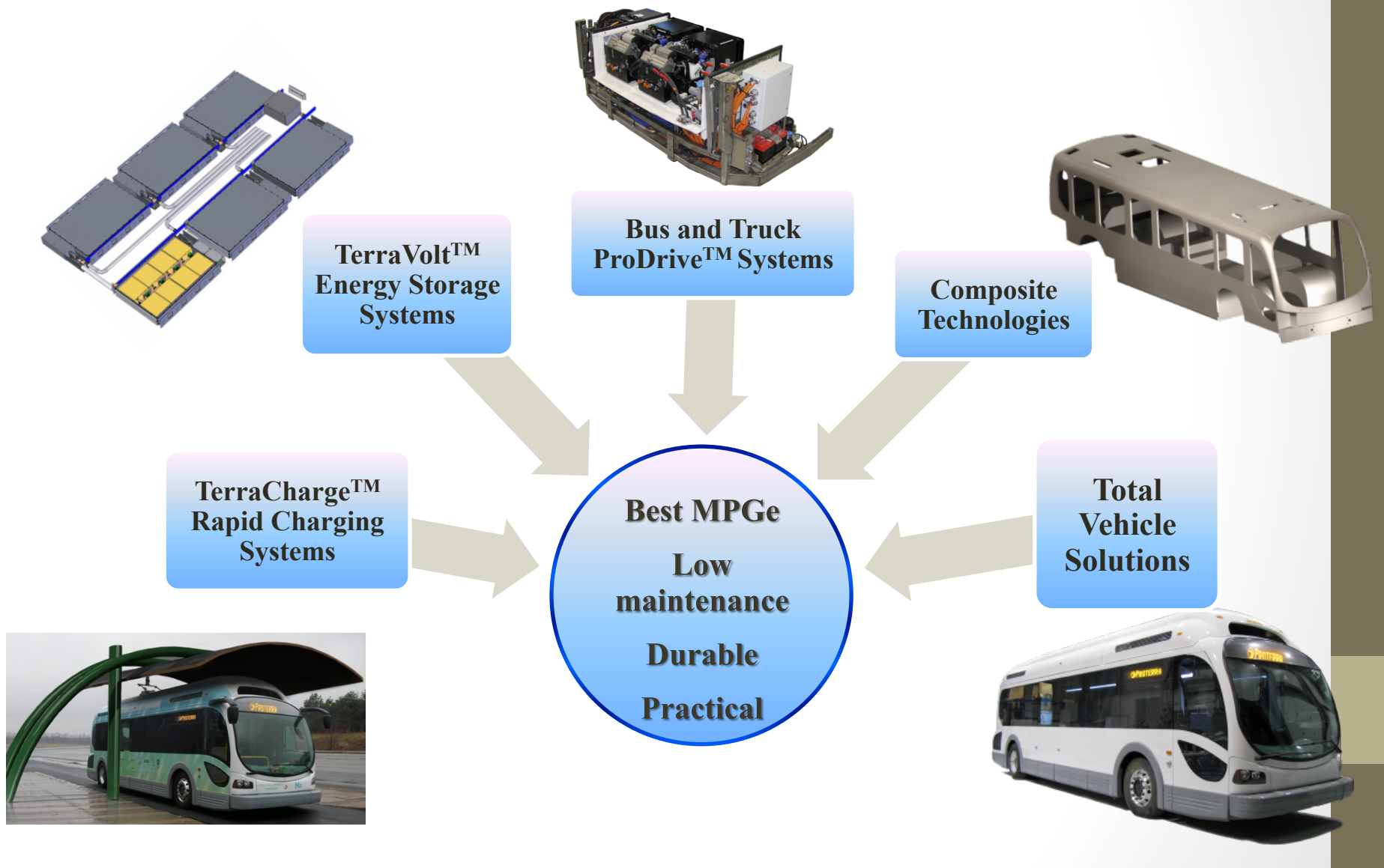


Eliminates all liquid fuel
and tail pipe emissions

The Charger – FastFill™ Charge Station

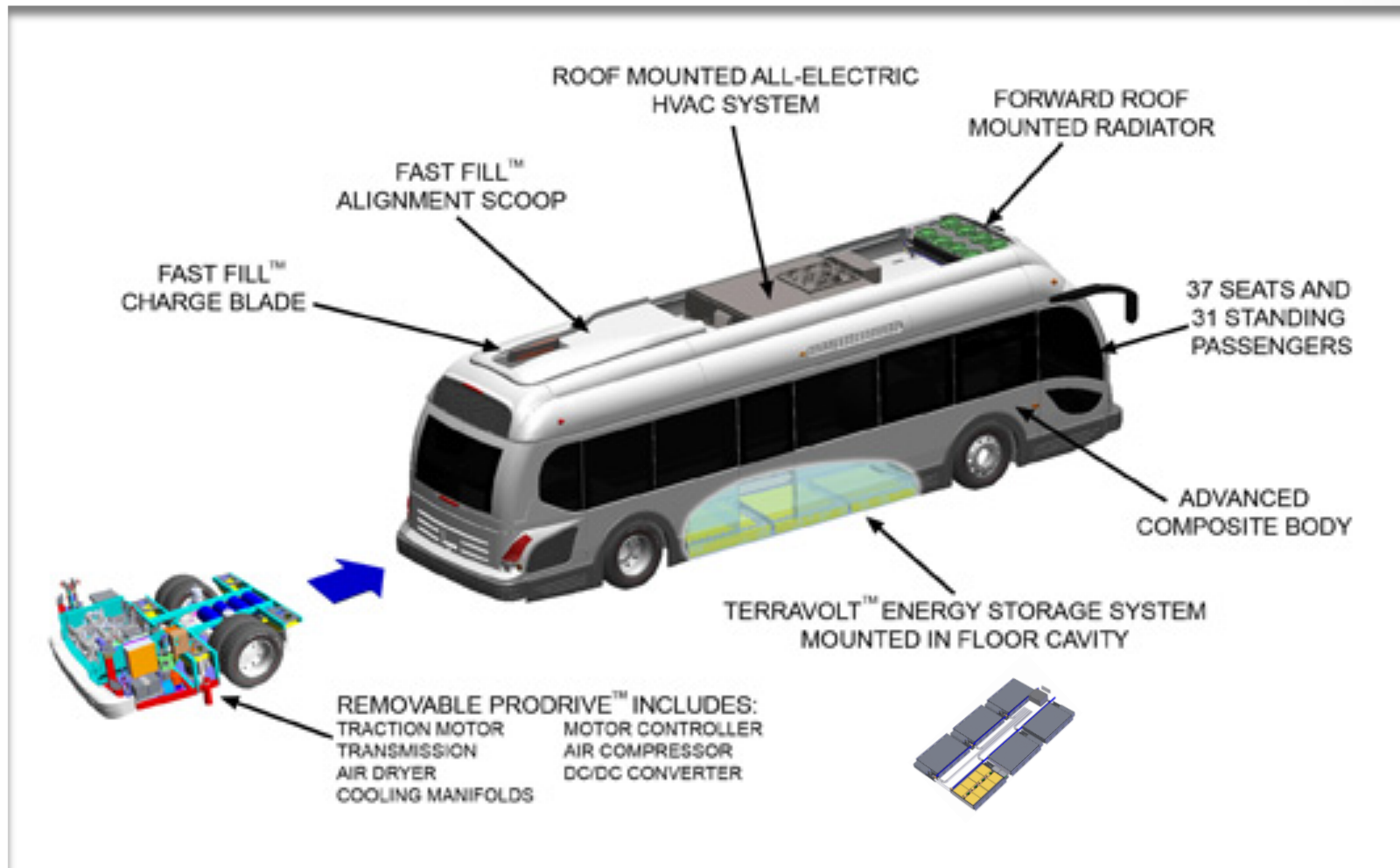


Proterra's Product Highlights

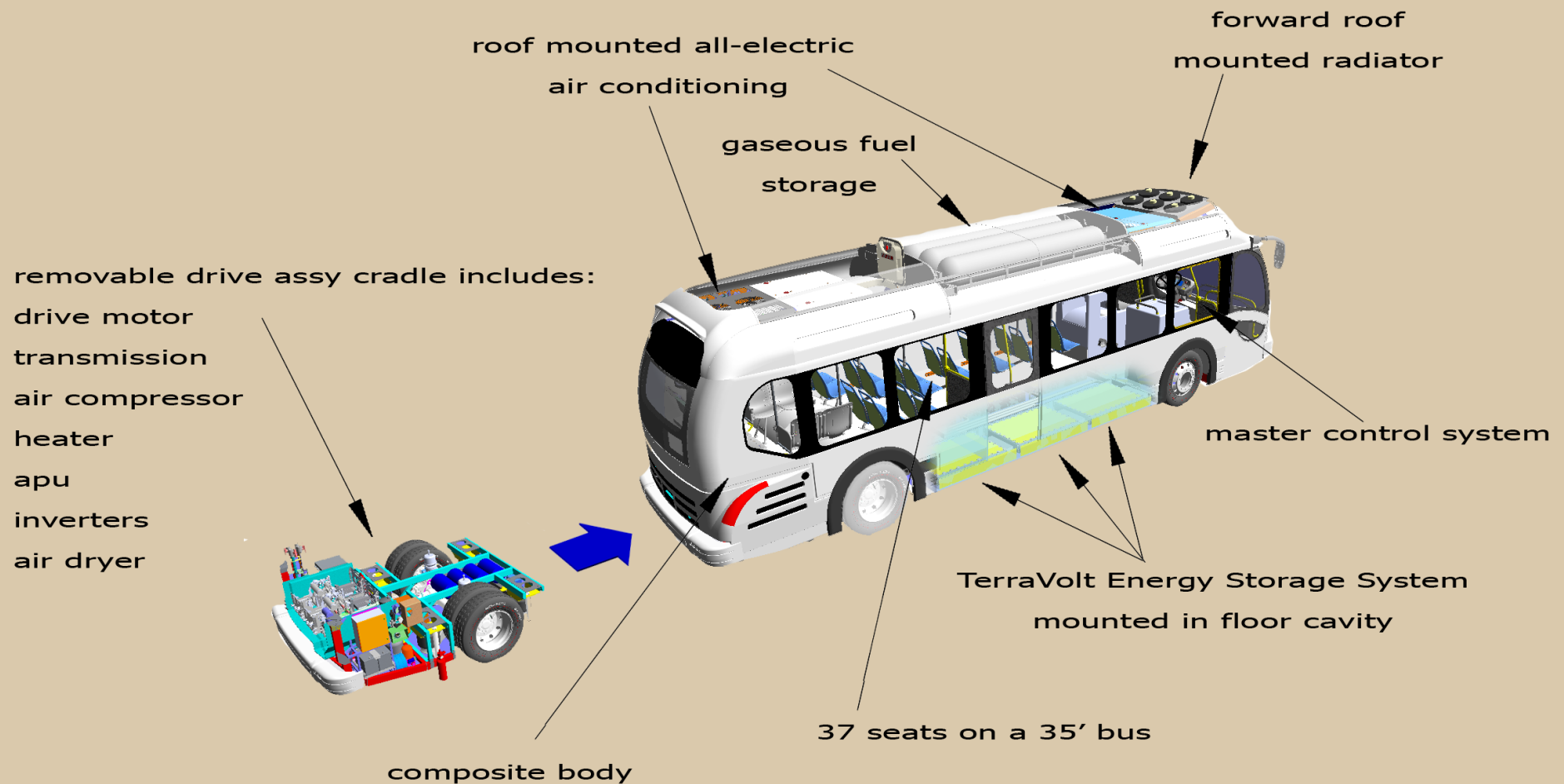


The Bus - ECORIDE HFC35

35' Composite



35' Composite Body, Fast Charge Battery Electric with Fuel Cell Range Extension



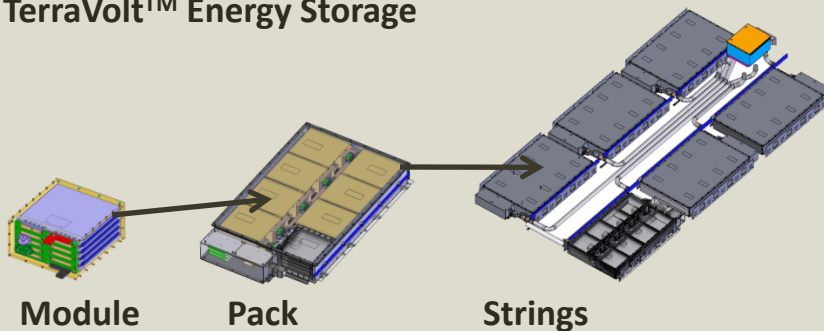
TerraVolt™ Energy Storage System

Core System Components

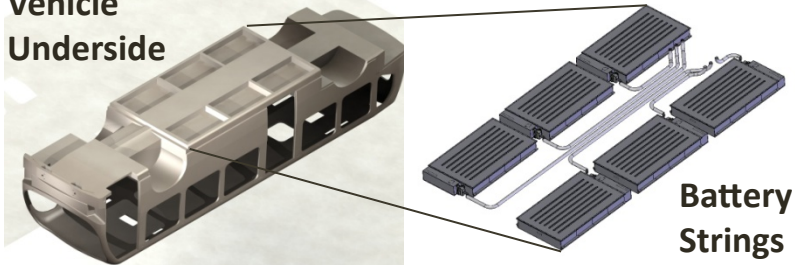


Battery Management System

TerraVolt™ Energy Storage



Vehicle
Underside

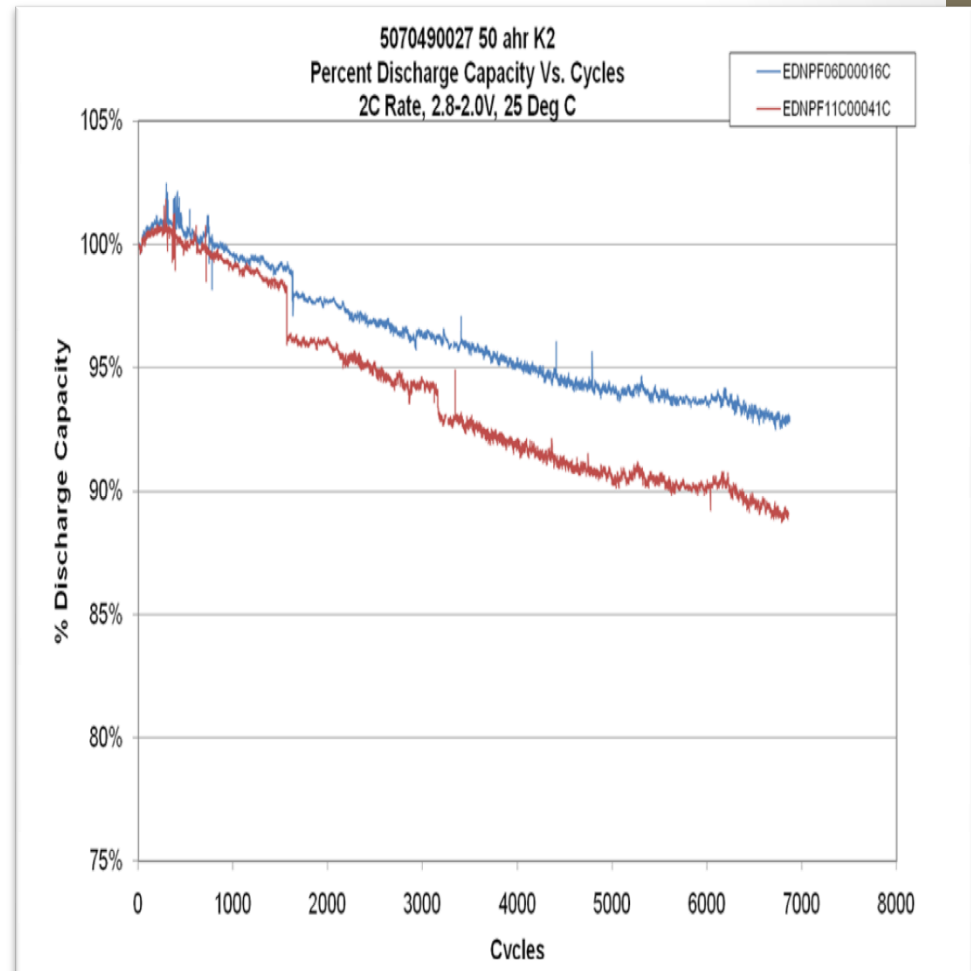


Customer Benefits

- Industry's only system that can be fully charged in less than 10 minutes
- Ultra safe system design
 - Puncture and heat resistant
 - Sophisticated battery management system operates at the 'cell' level
- Energy storage system outlasts the vehicle or longer
- Scales in size and energy capacity to suit vehicle type and duty cycle needs

Advanced TerraVolt Energy Storage Testing

- Build upon cell and module level testing and full vehicle system testing to add confidence to our lifetime and durability of the ESS as applied to the Foothill proposed drive cycle
- Have partnerships with NREL and FTA (Penn State University) as well as UC-Davis for various portions of the complete ESS testing
- Once complete we can then address long term warranty of the complete ESS



Estimated Efficiency of the Hybrid System

>80% Efficient Drive Train Without APU

- Battery System = 98.5% Avg.
- Traction Motor = 92.5% Peak; 85% Avg.

45% Efficient APU

- DC-DC Converters = 94% Peak; 90% Avg.
- Fuel Cells = 55% Peak; 50% Avg.

85% Efficient Hotel Loads

- HVAC: 85% Efficient -11.8kW Peak; 9kW Avg.
- Power Steering: 80% Efficient - 5kW Peak; 1kW Avg.
- DC-DC Converters: 90% Efficient; 1kW Avg. Waste



**>55% Efficiency
at 32kW/ hr**

Proterra FastFill™ Docking Process

1

Bus Identification

- Positively ID Proterra Bus (RFID)
- Begin Auto Speed Limiting
- Wireless Communication Between Bus and Charger



2

Sense Front of Bus

- Begin Roof-Top Feature Detection
- Uses Ultrasonic Distance Sensor



3

Roof-Top Feature Location Checks

- Check That Feature Locations are Detected Within Appropriate Window
- Features: Front of Bus, Front of A/C, Rear of A/C, Landing Scoop
- Multiple Checks for Robustness and Wider Location Tolerance



Proterra FastFill™ Docking Process (Cont.)

All in Under 10 Minutes

4

Land Charge Head

- Automatically Stop Bus in Correct Landing Location
- Land Charge Head on Guide Scoop



5

Seat Charge Head / Charging

- Move Bus FWD to Seat Charge Head with Bus
- Automatically Stop Bus
- Extend Charging Brushes and Begin Charging
- Allow Passenger Exchange (Doors Open)



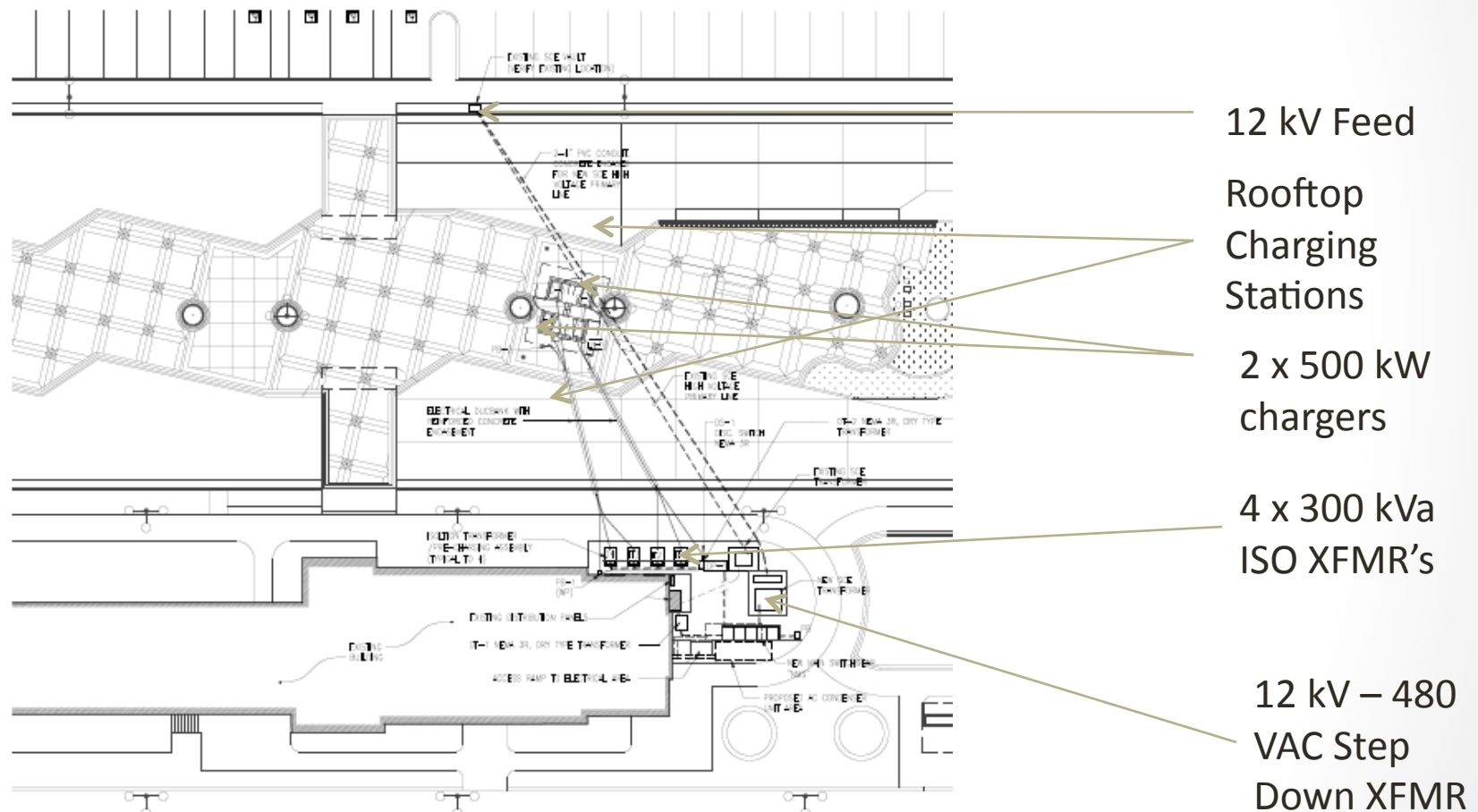
6

Charge Complete

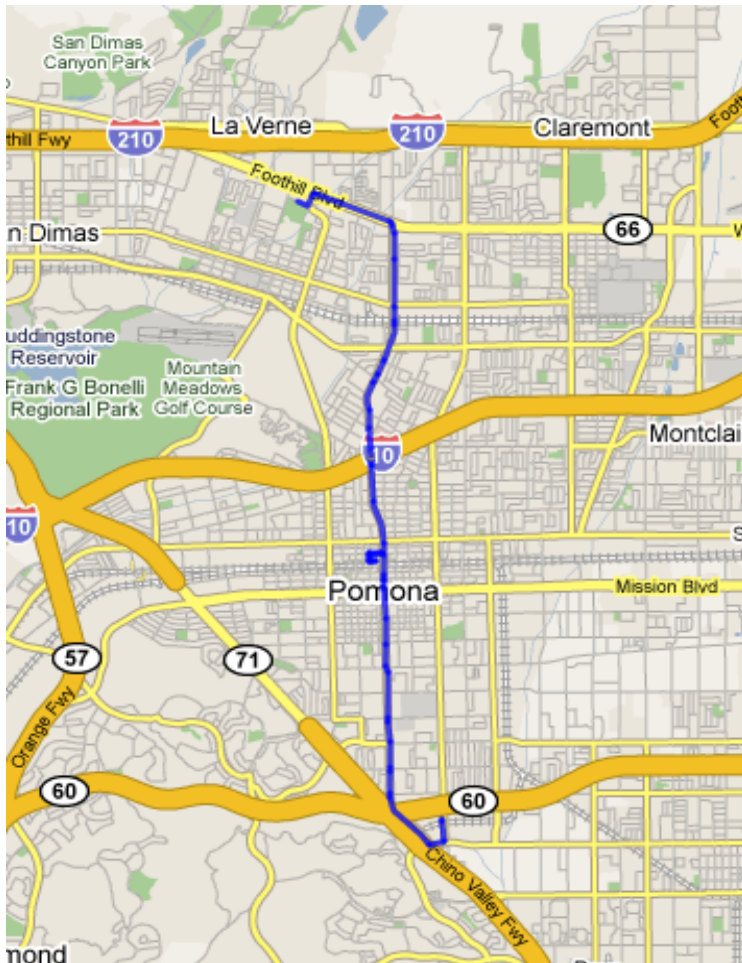
- Retract Brushes
- Raise Charge Head
- Bus Ready for Service



The Charger – Foothill Application



The Application



Estimated Route Data (from Foothill):

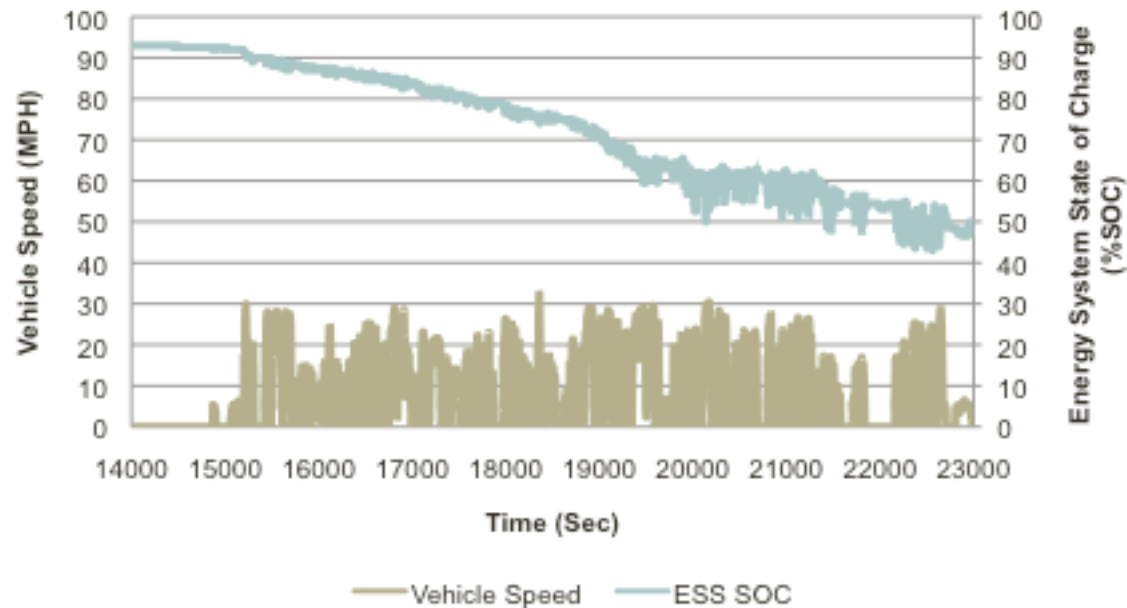
➤ Weekday:

- 9 Active Buses
- ~120 mi per bus per day
- 12.46 mph avg speed
- 12.8 hrs revenue service per day
- 0.8 hrs layover time per day

➤ Weekend

- 5 Active Buses
- ~85 mi per bus per day
- 12.5 mph avg speed
- 9.78 hrs revenue service per day
- 0.86 hrs layover time per day

Application Data and Observations – Foothill Transit



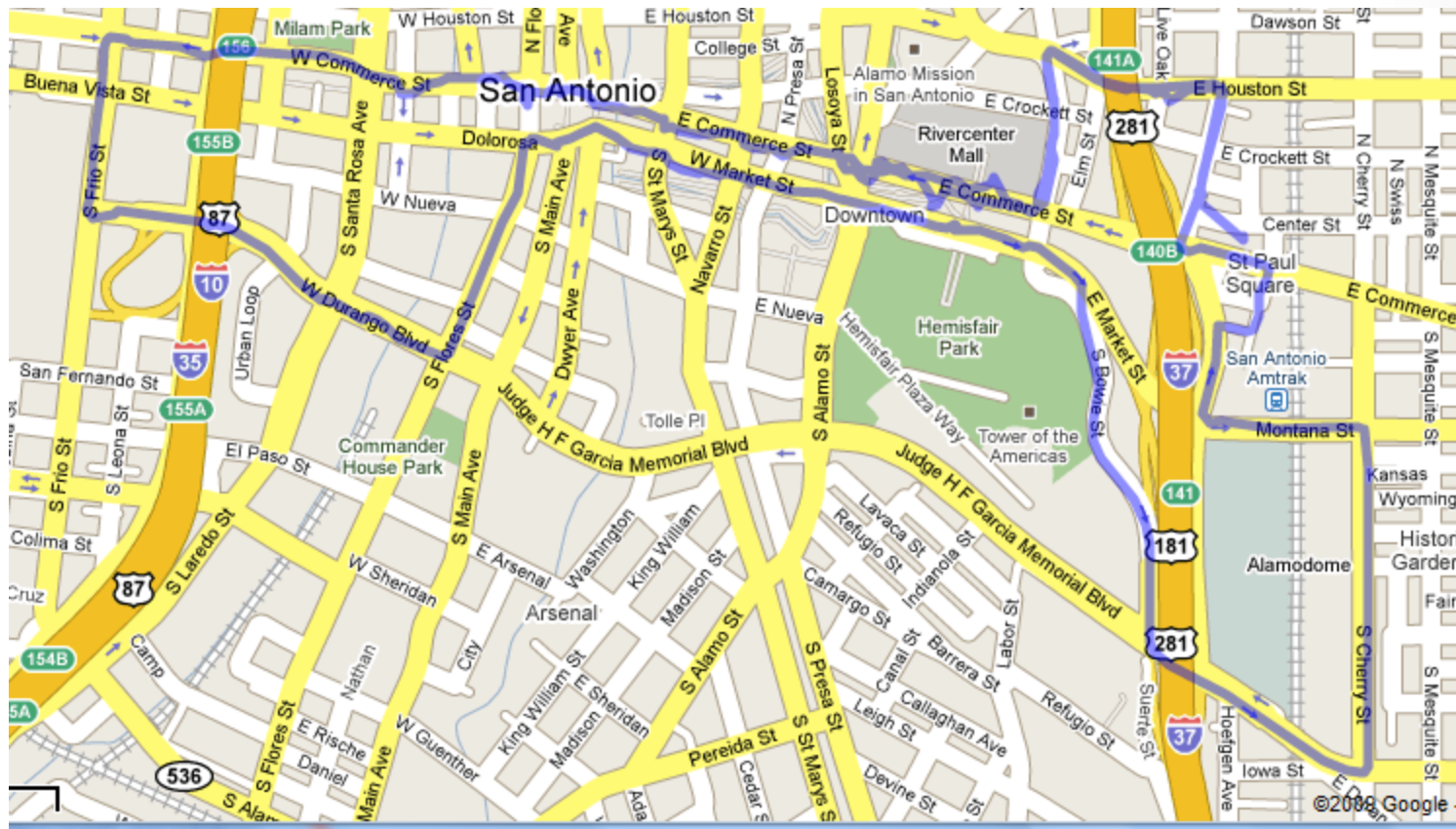
Observed Range of Efficiency

- 1.2 – 1.7 kWh/mi or 18 – 26MPGe
- Depends on driver, HVAC use, passenger load, and traffic conditions

Other Observations

- Drivers, techs, and passengers excited -enjoy learning and understanding.
- Upfront collaboration with local governments, utilities, etc. important .

VIA Metropolitan – San Antonio, TX



- Ideal Downtown Circulator Route, High Ridership and Visibility

Proterra's Customer Value Proposition Addresses Your Increasing Needs and Expectations

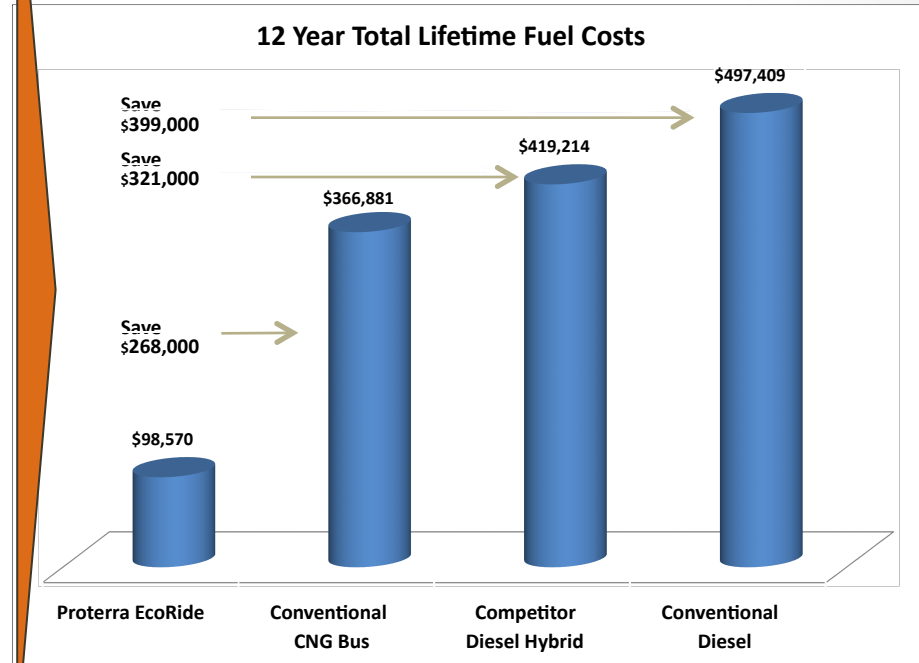
Lower total lifetime cost of ownership

- Dramatically better fuel economy
 - ❑ 20 MPGe
 - ❑ 400%-500% fuel economy increase over conventional diesel and diesel hybrids
 - ❑ ~\$400,000 in lifetime fuel cost savings
- More stable and secure fuel supply and prices ⁽¹⁾
- Reduction in maintenance and total payroll costs
 - ❑ Elimination of oil changes, engine overhauls, other engine related maintenance
 - ❑ Elimination of nightly fueling activities

Meets political, environmental and community needs

- Zero emissions architecture
- Ultra-low noise
- Smaller vehicle for urban and suburban use

EcoRide™ Saves You Nearly \$400,000 in Fuel Cost Per Vehicle Over 12 Years



⁽¹⁾ Electricity is characterized by a slower and more stable rate of increase in cost than liquid fuels since it can be generated by a diverse number of sources – cite to fuel increases in last 12 years – 190% increase for diesel, 123% increase for compressed natural gas, 49% increase for electricity

Thanks To Our Project Partners

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- US Federal Transit Administration
- California Air Resources Board
- Foothill Transit
- VIA San Antonio, TX
- Southern California Edison
- Center for Transportation and the Environment
- City of Columbia, SC
- City of Burbank, CA
- Burbank Transportation Management Organization
- US Department of Defense
- California Hydrogen Business Council
- California Fuel Cell Partnership
- National Renewable Energy Laboratory
- AltAirNano
- UQM Technologies
- AeroVironment
- Hydrogenics Corporation

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